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Trematodes from Kyphosid Fishes in Japanese and Adjacent Waters

By

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Abstract Nine species of trematodes are described from kyphosid fishes from Japanese and the adjacent waters. They are: *Discocephalotrema kyphosi* gen. et sp. nov. (Haplosplanchnidae), *Enenterum elongatum* YAMAGUTI, 1970, *E. kyphosi* YAMAGUTI, 1970, *E. mannarensis* HAFEEZULLAH, 1980, *Cadenatella isuzumi* sp. nov., *Jeancadenatia pacifica* YAMAGUTI, 1970 (Enenteridae), *Koseiria xishaense* GU et SHEN, 1983 (Lepocreadiidae), *Deontacylix* sp. (Sanguinicolidae) and *Deretrema* sp. (Zoogonidae). A new subfamily *Discocephalotrematinae* is proposed for the genus *Discocephalotrema*.

Descriptions of four species of hemiurid trematodes from kyphosid fish in Japanese waters have been published (MACHIDA, 1980, 1989). Additional nine species of trematodes including two new ones are described here from kyphosid fishes in Japanese and the adjacent waters.

Most trematodes were fixed in AFA or 70% ethanol under coverglass pressure, stained with Heidenhain's hematoxylin or alum carmine and mounted in balsam. Some trematodes were dehydrated by serial ethanol, critical point dried, coated with gold and examined in a SEM (JEOL-T 220). The specimens are deposited in the National Science Museum, Tokyo (NSMT).

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Family Haplosplanchnidae

Discocephalotrematinae subfam. nov.

Body cylindrical. Oral sucker replaced by a flat disk. Pharynx globular. Caeca single, terminating some distance anterior to posterior extremity. Acetabulum near anterior 1/3 of body length. Testis single, at equatorial. Seminal vesicle bipartite. Hermaphroditic duct surrounded by gland cells. Genital pore anterior to acetabulum. Ovary rounded, just anterior to testis. Seminal receptacle present. Vitellaria follicular, extending from ovarian level to caecal termination. Uterus lying between ovary

and acetabulum. Eggs large. Excretory vesicle not traced, pore terminal. Parasitic in marine teleosts.

Discocephalotrema gen. nov.

Body cylindrical. Oral sucker replaced by a muscular flat disk. Pharynx globular. Caeca single, terminating some distance in front of posterior extremity. Acetabulum near anterior 1/3 of body length. Testis single, at equatorial. Seminal vesicle bipartite and arcuate. Hermaphroditic duct surrounded by a number of gland cells. Genital pore slightly anterior to acetabulum. Ovary entire, just anterior to testis. Seminal receptacle present. Vitellaria follicular, extending from ovarian level to caecal termination. Uterus lying between ovary and acetabulum. Eggs large. Excretory vesicle indistinct, pore terminal. Parasitic in marine teleosts.

Type species: *Discocephalotrema kyphosi* sp. nov.

Discocephalotrema kyphosi sp. nov.

(Fig. 1)

Material examined. Five specimens from pyloric caeca of *Kyphosus cinerascens*, Okinawa I., 22-I-1990 (NSMT-Pl 3823, holotype and paratypes).

Description. The worm inserts the body into a branch of the pyloric caeca of the host. The lumen of caecum is blocked by the discoid oral sucker of the worm. Body cylindrical, nail-shaped, dark red in color in life, 8.3–13.3 mm in length and 1.3–1.6 mm in maximum width at acetabular level. Oral sucker replaced by a muscular flat disk like a nailhead, 0.80–0.95×1.05–1.29 mm. Mouth a transverse slit. Prepharynx 0.15–0.45 mm long. Pharynx globular, well-developed, 0.43–0.50×0.47–0.63 mm. Caeca single, voluminous, terminating 0.9–1.8 mm in front of posterior extremity. Acetabulum smaller than oral sucker, slightly protruded, 0.50–0.66×0.45–0.75 mm. Sucker ratio 1: 0.4–0.6. Forebody 26–33% of body length.

Testis single, rounded to ovoid, 0.60–0.93×0.73–0.80 mm, at or near equatorial level. Posttesticular space 43–52% of body length. Seminal vesicle bipartite, arcuate, up to 0.40 mm wide, extending posteriorly to ovarian level. Hermaphroditic duct up to 0.46 mm long, surrounded by a number of large gland cells. Genital pore slightly anterior to acetabulum.

Ovary ovoid, transversely elongated, 0.25–0.41×0.40–0.45 mm, anterior to and usually in contact with testis. Seminal receptacle globular, 0.20–0.48×0.20–0.79 mm, dorsal to level between ovary and testis. Laurer's canal absent. Uterus winding transversely between ovary and acetabulum. Uterine eggs oval, 92–113×74–85 µm. Vitellaria composed of small follicles, extending from anterior level of ovary to a level of caecal termination. Excretory vesicle cannot be traced; pore terminal.

Discussion. This species resembles the members of the genus *Hymenocotta*, *H. mulli* MANTER, 1961 and *H. manteri* OVERSTREET, 1969, in the oral sucker replaced by a disk, but differs from them in that each of the latter has a lobed or flared oral disk,

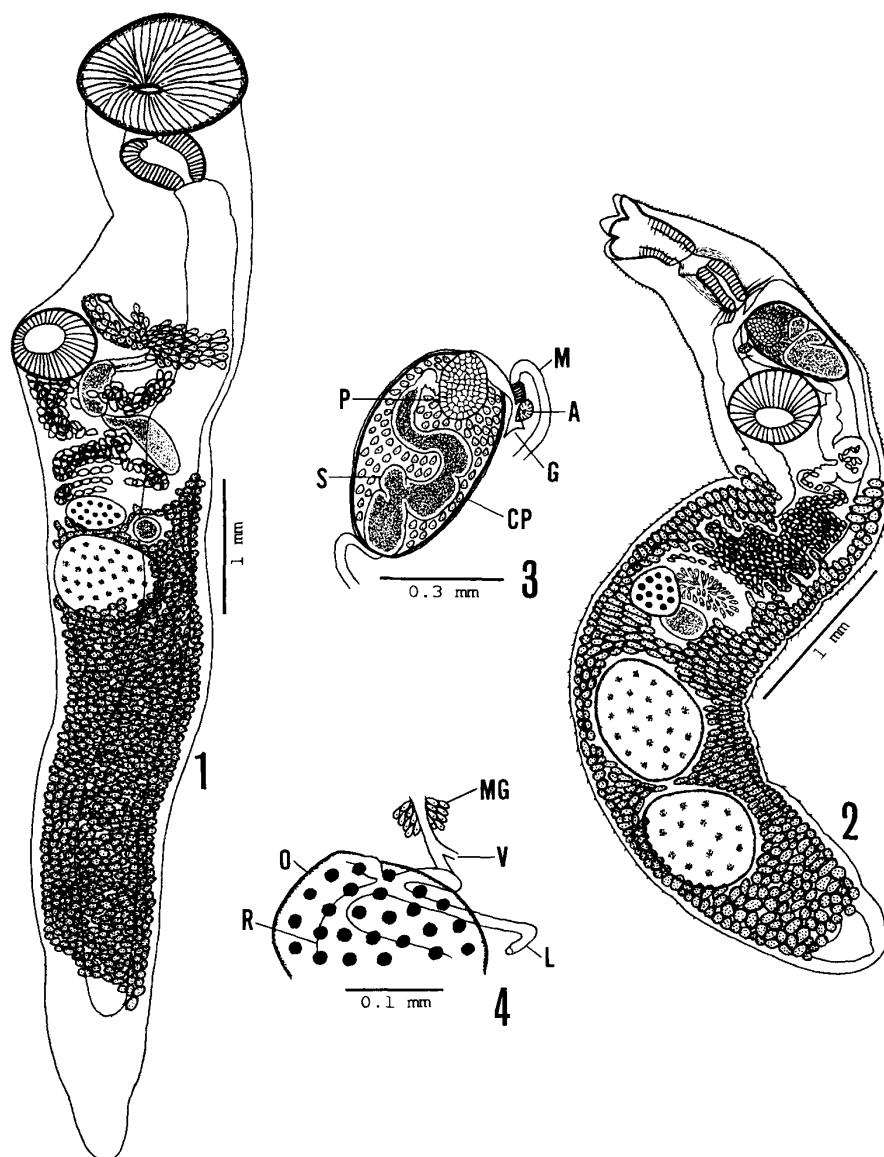


Fig. 1. *Discocephalotrema kyphosi* gen. et sp. nov., ventral view (holotype, NSMT-P1 3823).
 Figs. 2-4. *Enenterum mannarensis* HAFEEZULLAH, 1980. — 2. Entire worm, ventral view (NSMT-P1 4200 a). 3. Terminal genitalia, ventral view. 4. Ovarian complex, ventral view.
 A, accessory sucker; CP, cirrus pouch; G, genital pore; L, Laurer's canal; M, metraterm; MG, Mehlis' gland; O, ovary; P, pars prostatica; R, seminal receptacle; S, seminal vesicle; V, vitelline duct.

a long tubular seminal vesicle, and tubular vitellaria extending far beyond the caecal termination. A new subfamily *Discocephalotrematinae* is proposed with the above given diagnosis.

Family Enenteridae

Enenterum elongatum YAMAGUTI, 1970

Material examined. Four specimens from intestine of *Kyphosus* sp., Palau, 30–

VI-1980 (NSMT-P1 2416) and one specimen from mid-intestine of *K. cinerascens*, Okinawa I., 19-V-1992 (NSMT-P1 4256).

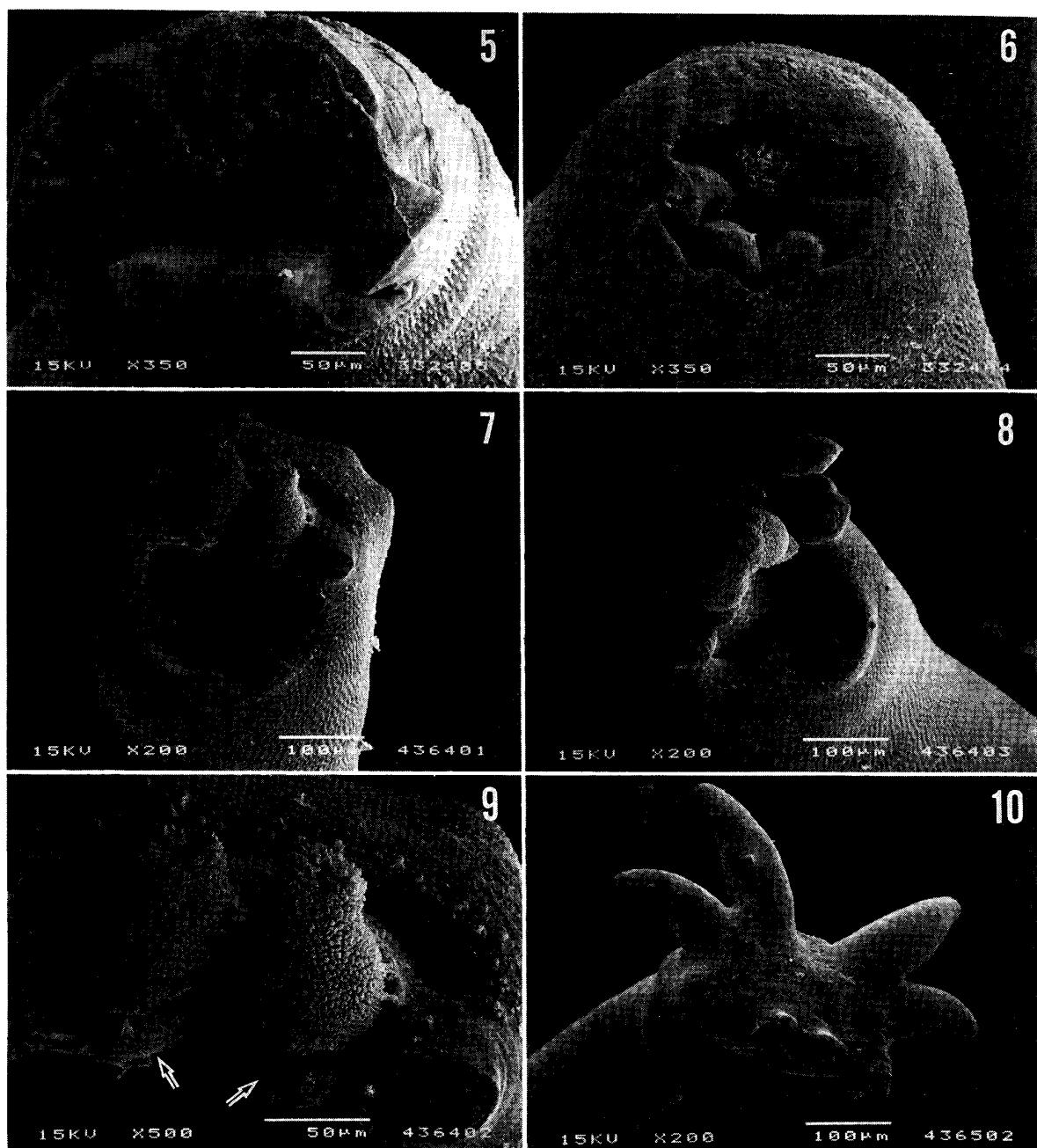
Description. Body orange in color in life, 10.0–13.5 mm long by 1.0–1.6 mm wide. Oral sucker $0.74\text{--}1.02 \times 0.51\text{--}0.78$ mm, with five marginal lobes which are divided into two blunt-conical lobes. Prepharynx up to 0.44 mm long. Pharynx $0.26\text{--}0.35 \times 0.25\text{--}0.38$ mm. Esophagus up to 0.12 mm long. Acetabulum $0.46\text{--}0.65 \times 0.46\text{--}0.68$ mm. Forebody 16–20% of body length. Anterior testis $0.87\text{--}1.38 \times 0.60\text{--}0.80$ mm and posterior testis $0.10\text{--}1.53 \times 0.55\text{--}0.75$ mm. Both testes entire, situated in 61–87% of body length from anterior extremity. Posttesticular space 13–16% of body length. Cirrus pouch $0.42\text{--}1.01 \times 0.26\text{--}0.45$ mm. Ovary entire, $0.35\text{--}0.55 \times 0.31\text{--}0.44$ mm, lying 49–52% of body length from anterior extremity. Seminal receptacle $0.41\text{--}0.54 \times 0.18\text{--}0.52$ mm. Uterine eggs $59\text{--}73 \times 38\text{--}44 \mu\text{m}$.

Enenterum kyphosi YAMAGUTI, 1970

Material examined. Seven specimens from mid-intestine of *Kyphosus lembus*, Ogasawara I., 8-VII-1963 (NSMT-P1 2004) and five specimens from intestine of *Kyphosus* sp., Palau, 29-IV-1980 (NSMT-P1 2383).

Description. Body orange in color in life, 3.8–9.3 mm long by 1.1–2.0 mm wide. Oral sucker $0.39\text{--}0.88 \times 0.32\text{--}0.75$ mm, with the same marginal lobes as *E. elongatum*. Prepharynx up to 0.24 mm long. Pharynx $0.17\text{--}0.40 \times 0.20\text{--}0.42$ mm. Esophagus up to 0.21 mm long. Acetabulum $0.36\text{--}0.84 \times 0.43\text{--}0.94$ mm. Forebody 20–32% of body length. Anterior testis $0.28\text{--}0.82 \times 0.41\text{--}0.75$ mm and posterior testis $0.30\text{--}0.87 \times 0.41\text{--}0.71$ mm. Both testes entire or indented, situated in 58–88% of body length from anterior extremity. Posttesticular space 12–23% of body length. Cirrus pouch $0.30\text{--}0.87 \times 0.18\text{--}0.58$ mm. Ovary entire or indented, $0.16\text{--}0.44 \times 0.19\text{--}0.39$ mm, lying 49–58% of body length from anterior extremity. Seminal receptacle $0.15\text{--}0.36 \times 0.08\text{--}0.26$ mm. Uterine eggs $59\text{--}72 \times 33\text{--}44 \mu\text{m}$.

Discussion. YAMAGUTI (1970) described two new species of *Enenterum*, *E. elongatum* and *E. kyphosi*, from *Kyphosus cinerascens* in Hawaiian waters. According to him, *E. elongatum* was characterized by the body being elongate, no esophagus, and the testes lying near the posterior extremity. In addition, the ovary and testes were incised or lobed in *E. kyphosi*. Based on the body shape, I tentatively divided my specimens into two species: the elongate specimens which belongs to *E. elongatum* and the foliate ones to *E. kyphosi*. My specimens considerably varied in the body shape and it was often difficult to decide which species some of them belonged to. In my specimens of *E. elongatum*, the esophagus was recognizable, and the relative position of testes to the body length agreed with that of *E. kyphosi*. In my specimens of *E. kyphosi*, some had entire testes and ovary, and the others had indented ones. The variation in shape of body, testes and ovary, and the relative position of testes to the body length suggested *E. elongatum* and *E. kyphosi* to be the same species. Additional observations may reveal that *E. kyphosi* is conspecific with *E. elongatum*.



Figs. 5-6. SEM micrographs of oral suckers (slightly retracted) of *Enenterum mannarensis* HAFEEZULLAH, 1980, showing six lobes.

Figs. 7-9. SEM micrographs of eight preoral projections of *Cadenatella isuzumi* sp. nov. — 7. Four dorsal projections retracted. 8. Two right dorsal projections retracted. 9. Two midventral projections composed of villous dorsal and smooth ventral lobes (arrows).

Fig. 10. SEM micrograph of eight preoral projections of *Jeancadenatia pacifica* YAMAGUTI, 1970.

Enenterum mannarensense HAFEEZULLAH, 1980

(Figs. 2-6)

Material examined. Seven specimens from upper intestine of *Kyphosus cinerascens*, Kushimoto, 29-X-1979 (NSMT-P1 2286), one specimen from lower intestine of *K. cinerascens*, Okinawa I., 21-V-1983 (NSMT-P1 2795) and two specimens from intestine of *K. cinerascens*, Okinawa I., 12-VI-1991 (NSMT-P1 4200 a).

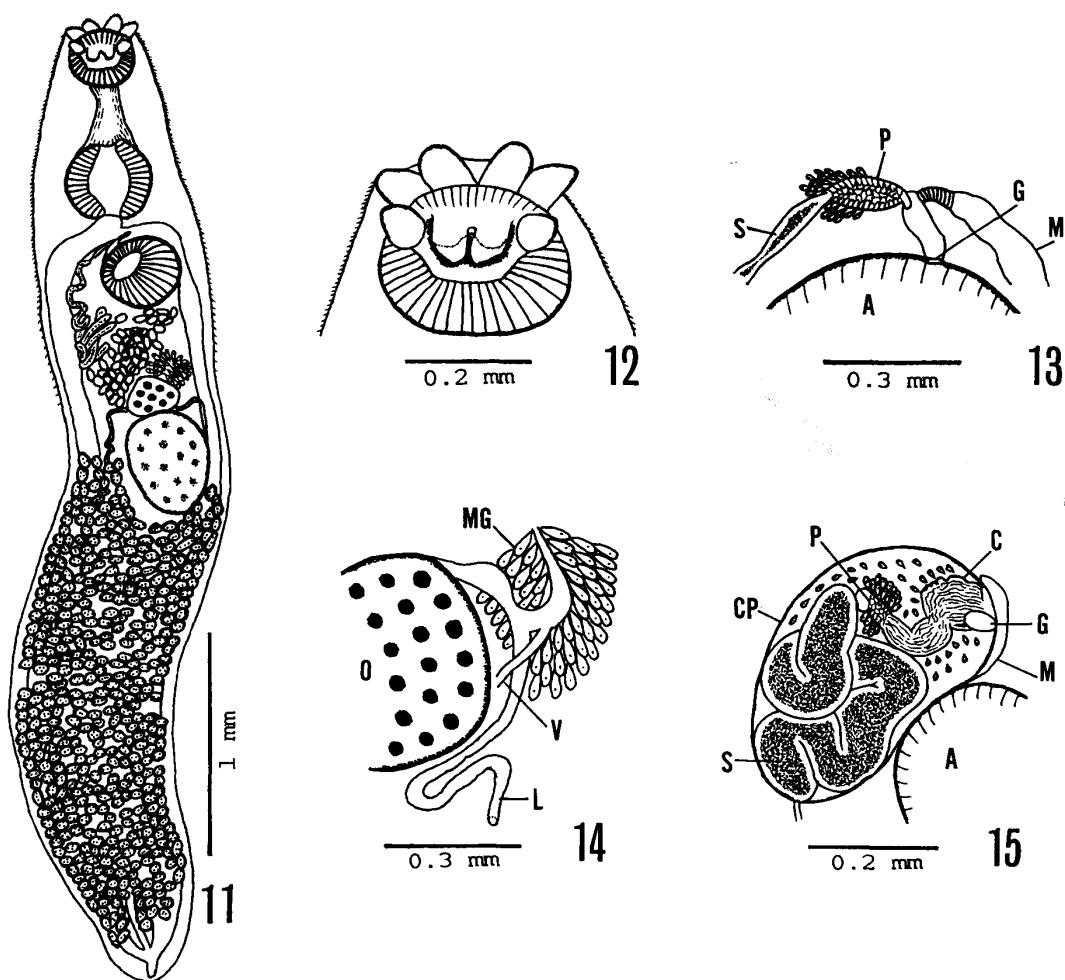
Description. Body foliate to elongate, orange in color in life, 3.7-6.1 mm long by 0.77-1.03 mm wide. Cuticle spinose except for posterior part of body. Oral sucker 0.32-0.59 \times 0.23-0.57 mm, dividing anteriorly into six lobes in the form of a petal. Six lobes not subdivided. Oral sucker can be retracted into anterior end of body. Prepharynx 0.06-0.30 mm long. Pharynx 0.21-0.32 \times 0.14-0.19 mm. Esophagus up to 0.13 mm long, not recognized in contracted specimens. Acetabulum 0.31-0.47 \times 0.42-0.54 mm, with several papillae surrounding the orifice. Sucker ratio 1: 0.9-1.8. Forebody 24-29 % of body length. Testes smooth or occasionally irregular in surface; anterior testis 0.32-0.78 \times 0.38-0.60 mm and posterior testis 0.38-0.70 \times 0.41-0.64 mm. Posttesticular space 11-31 % of body length. Cirrus pouch large, saccular, 0.45-0.65 \times 0.23-0.34 mm, situated between caecal bifurcation and acetabulum, sometimes with its posterior end extending to midacetabular level, containing tubular, winding seminal vesicle and oval pars prostatica with prostatic cells. Ejaculatory duct short, joining metraterm to form short genital atrium. Genital pore midway between pharynx and acetabulum, with a small accessory sucker just inside genital pore. Ovary ovoid, entire, 0.20-0.32 \times 0.23-0.31 mm, near midbody. Seminal receptacle 0.18-0.50 \times 0.26-0.60 mm, dorsal or posterodorsal to ovary. Laurer's canal opening dorsally anterosinistral to ovary. Metraterm well-developed, running along sinistral border of acetabulum, having a sphincter just before joining with ejaculatory duct. Uterine eggs 56-67 \times 32-37 μ m. Excretory vesicle tubular, reaching near ovary.

Discussion. This species was initially described by HAFEEZULLAH (1980) based on one specimen from *Kyphosus cinerascens* of India. Later, BRAY (1986) collected five rather contracted specimens of this species from *K. vaigiensis* of South Africa. The oral sucker was divided anteriorly into six lobes and in this respect was unique in the genus. With the exception of well-developed cirrus pouch, my specimens agreed fairly well with the original description by HAFEEZULLAH.

Cadenatella isuzumi sp. nov.

(Figs. 7-9, 11-14)

Material examined. One specimen from intestine of *Kyphosus cinerascens*, Okinawa I., 17-V-1983 (NSMT-P1 2776 b, paratype), two specimens from mid-intestine of *K. cinerascens*, Okinawa I., 26-III-1988 (NSMT-P1 3375, paratypes), two specimens from mid-intestine of *K. cinerascens*, Okinawa I., 6-VI-1991 (NSMT-P1 4160, paratypes), five specimens from upper intestine of *K. cinerascens*, Okinawa I.,



Figs. 11-14. *Cadenatella isuzumi* sp. nov. — 11. Entire worm, ventral view (holotype, NSMT-P1 4198). 12. Oral sucker, ventral view. 13. Terminal genitalia, ventral view. 14. Ovarian complex, ventral view.

Fig. 15. Terminal genitalia of *Koseiria xishaense* GU et SHEN, 1983, ventral view.

A, acetabulum; C, cirrus; CP, cirrus pouch; G, genital pore; L, Laurer's canal; M, metraterm; MG, Mehlis' gland; O, ovary; P, pars prostatica; S, seminal vesicle; V, vitelline duct.

12-VI-1991 (NSMT-P1 4198, holotype and paratypes) and three specimens from upper intestine of *K. cinerascens*, Okinawa I., 19-V-1992 (NSMT-P1 4253, paratypes).

Description. Body elongate, yellowish or light orange in color in life, 4.3-9.7 mm long by 0.72-1.09 mm wide. Cuticle spinose from anterior extremity to posttesticular level. Oral sucker $0.24-0.40 \times 0.28-0.45$ mm, with eight muscular lobate preoral projections, four dorsal and four ventral. Two midventral projections covered with villous processes, having a small ventral lobe at the base in each. The ventral lobe with rather smooth surface. Several pairs of papillae just inside and outside the orifice of oral sucker. Oral sucker can be retracted into anterior end of body. Prepharynx 0.20-0.40 mm long. Pharynx pyriform, well-developed, $0.28-0.43 \times$

0.29–0.44 mm. Esophagus 0.05–0.12 mm long. Caeca extending to posterior extremity, joining excretory vesicle to form uroproct with terminal pore. Acetabulum rounded, $0.30\text{--}0.43 \times 0.33\text{--}0.48$ mm. Sucker ratio 1:0.9–1.4. No accessory suckers. Forebody 16–32% of body length.

Testis single, oval to elongate, $0.47\text{--}0.79 \times 0.17\text{--}0.39$ mm. Posttesticular space 1.7–4.0 mm long, 36–48% of body length. Seminal vesicle slender, sinuous, up to 0.09 mm wide, extending posteriorly to midway between acetabulum and ovary or closer to ovary. Prostatic vesicle small, tubular to ovoid, 0.06–0.18 mm long, near anterior border of acetabulum. Genital atrium very short. Genital pore just in front of acetabulum.

Ovary rounded to ovoid, $0.18\text{--}0.27 \times 0.14\text{--}0.25$ mm, anterior to testis, in contact with, a little separated from, or obliquely anterior to testis. Laurer's canal opening dorsally at postovarian level or more posteriorly. Proximal portion of uterus containing spermatozoa. Uterus preovarian, intercaecal or occasionally overlapping caeca. Vitellaria composed of small follicles, extending from the level of middle or posterior 1/3 of testis to posterior extremity. Uterine eggs thin-shelled, $62\text{--}74 \times 41\text{--}46$ μm . Excretory vesicle Y-shaped, bifurcating at postovarian level; arms extending about midway between acetabulum and ovary.

Discussion. Four other species of *Cadenatella* with eight lobate preoral projections have been described, all from fishes of the genus *Kyphosus*: *C. cadenati* DOLLFUS, 1946 from Africa, *C. americana* MANTER, 1949 from Florida, *C. kyphosi* NAHHAS et CABLE, 1964 from Jamaica and *C. floridæ* OVERSTREET, 1969 from Florida. The present species differs from them in having no midventral accessory suckers in the forebody. SEM examination of my specimens revealed two midventral preoral projections to be composed of villous dorsal and smooth ventral lobes. This feature has not previously been described for the members of the genus *Cadenatella*. The specific name refers to the Japanese name of the host.

Jeancadenatia pacifica YAMAGUTI, 1970

(Fig. 10)

Material examined. Three specimens from upper intestine of *Kyphosus cinerascens*, Okinawa I., 22–I–1990 (NSMT-P1 3818), one specimen from upper intestine of *K. cinerascens*, Okinawa I., 31–I–1990 (NSMT-P1 3855), three specimens from upper intestine of *K. cinerascens*, Okinawa I., 6–VI–1991 (NSMT-P1 4164) and one specimen from upper intestine of *K. cinerascens*, Okinawa I., 19–V–1992 (NSMT-P1 4255).

Description. Body whitish in color in life, 9.7–15.3 mm long by 0.56–0.76 mm wide. Oral sucker $0.23\text{--}0.37 \times 0.25\text{--}0.36$ mm, with eight tentacular or lobate preoral projections. Middorsal two tentacular and longest, 0.21–0.32 mm long; dorsolateral two tentacular and the second longest, 0.14–0.23 mm long; ventrolateral two lobate, 0.07–0.12 mm long; and midventral two small and each of them has trifid end, 0.05–0.10 mm long. Several pairs of papillæ just outside and inside the orifice of oral

sucker. Prepharynx 0.14–0.48 mm long. Pharynx $0.33\text{--}0.49 \times 0.17\text{--}0.24$ mm. Esophagus 0.16–0.80 mm long. Acetabulum $0.27\text{--}0.39 \times 0.30\text{--}0.39$ mm. Sucker ratio 1: 1.0–1.4. No accessory suckers. Forebody 12–19% of body length. Testis single, $1.55\text{--}2.70 \times 0.25\text{--}0.34$ mm. Posttesticular space 26–47% of body length. Seminal vesicle tubular, extending to a level midway between acetabulum and ovary. Prostatic vesicle small, 56–88 μm long. Cirrus pouch absent. Genital pore slightly anterior to acetabulum. Ovary subglobular, $0.21\text{--}0.33 \times 0.22\text{--}0.33$ mm. Laurer's canal opening dorsally in ovarian zone or a little more posteriorly. Seminal receptacle absent and uterine seminal receptacle present. Uterine eggs $56\text{--}67 \times 36\text{--}42 \mu\text{m}$. Vitellaria extending from posterior third of testis to posterior extremity.

Discussion. YAMAGUTI (1970) described this species from *Kyphosus cinerascens* in Hawaiian waters. My specimens agreed well with his description except for the number of preoral projections. Reexamination of paratypes of this species (MPM Coll. No. 15148) showed that YAMAGUTI overlooked a pair of lobate ventrolateral projections. Actually, this species had eight preoral projections.

NAHHAS and CABLE (1964) considered *Jeancadenatia* a synonym of *Cadenatella*. Observation on my specimens of *C. isuzumi* and *J. pacifica* revealed the difference between the two genera to be in the shape and size of the preoral projections. In *C. isuzumi*, eight preoral projections were lobate and almost the same sized, and the two midventral projections were composed of dorsal and ventral lobes, and the dorsal lobes were covered with villous processes. In *J. pacifica*, eight preoral projections varied in shape and size: dorsal four were tentacular, of them the middle two were longer, ventrolateral two were lobate, and midventral two were small, having trifid end. I am following YAMAGUTI (1970) and HAFEEZULLAH (1980) and accepting the genus *Jeancadenatia*.

Family Lepocreadiidae

Koseiria xishaense GU et SHEN, 1983

(Fig. 15)

Material examined. One specimen from intestine of *Kyphosus cinerascens*, Kushimoto, 22–X–1979 (NSMT-P1 2233), two specimens from lower intestine of *K. cinerascens*, Okinawa I., 21–V–1983 (NSMT-P1 2795), one specimen from intestine of *K. cinerascens*, Okinawa I., 26–I–1990 (NSMT-P1 3838), two specimens from intestine of *K. cinerascens*, Okinawa I., 12–VI–1991 (NSMT-P1 4200 b) and two specimens from mid-intestine of *K. cinerascens*, Okinawa I., 28–V–1992 (NSMT-P1 4303).

Description. Body orange in color in life, 2.7–8.4 mm long by 0.87–1.83 mm wide. Oral sucker $0.29\text{--}0.62 \times 0.32\text{--}0.72$ mm. Prepharynx 0.10–0.46 mm long. Pharynx $0.21\text{--}0.43 \times 0.29\text{--}0.54$ mm. Esophagus 0.02–0.07 mm long. Acetabulum $0.20\text{--}0.42 \times 0.26\text{--}0.51$ mm. Sucker ratio 1: 0.6–0.8. Forebody 23–36% of body length. Anterior testis $0.41\text{--}1.50 \times 0.64\text{--}1.13$ mm and posterior testis $0.50\text{--}1.35 \times 0.58\text{--}1.13$ mm.

Posttesticular space 19–29 % of body length. Cirrus pouch $0.54\text{--}1.17 \times 0.16\text{--}0.75$ mm, containing sinuous tubular seminal vesicle, oval pars prostatica and S-shaped muscular cirrus. In one specimen, a cirrus 0.78 mm long evaginated outside through a genital pore was found. Genital sucker not observed. Ovary usually three or four lobed, occasionally slightly irregular, $0.16\text{--}0.49 \times 0.29\text{--}0.68$ mm. Seminal receptacle $0.16\text{--}0.61 \times 0.28\text{--}0.62$ mm. Uterine eggs $52\text{--}65 \times 30\text{--}39$ μm .

Discussion. My specimens agreed well with the original description of *Koseiria xishaense* from *Kyphosus cinerascens* in the South China Sea. This species was characterized by having an oral sucker consistently larger than the acetabulum, and three or four lobed ovary. In my specimens, the cirrus pouch contained a sinuous seminal vesicle, an oval pars prostatica and a muscular cirrus. The cirrus can be evaginated outside through a genital pore.

In addition, the following two species were obtained. The specimens were few and in poor preservation, so when adequate material is examined, they can be placed in the proper species.

Deontacylix sp. (Sanguinicolidae, probably *D. kyphosi* YAMAGUTI, 1970) found in gill washing of *Kyphosus* sp. from Palau, 30–VI–1980 (NSMT-P1 2388).

Deretrema sp. (Zoogonidae) from gall bladder of *K. cinerascens* from Okinawa I., 26–III–1988 (NSMT-P1 3373).

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